8. The nanocomposite of claim 1, wherein the clay material comprises sodium montmorillonite or sodium bentonite.

9. The nanocomposite of claim 1, wherein at least about 50 percent of the clay material is dispersed in the form of individual platelet particles and tactoids in the matrix polymer and the individual platelet particles have a thickness of less than about 2 nm and a diameter of from about 10 to about 3000 nm.

10. The nanocomposite of claim 1, wherein the clay material has less than about 1.0 % by weight of quartz particles.

11. The nanocomposite of claim 1, wherein the clay material is treated with an organic cation.

12. The nanocomposite of claim 11, wherein the organic cation is derived from ammonium salt compound.

13. The nanocomposite of claim 1, wherein the melt-processible matrix polymer comprises poly(*m*-xylylene adipamide) or a copolymer thereof, and the clay material comprises sodium montmorillonite or sodium bentonite.

14. An article prepared from the nanocomposite of claim 1.

15. The article of claim 14 in the form of film, sheet, pipe, an extruded article, a molded article, a molded container or bottle.

16. The article of claim 14, having a gas permeability which is at least about 10 percent lower than that of an article formed from a clay-free polymer.

17. The article of claim 14, having a haze which is at least about 4 percent lower than that of an article formed from a nanocomposite having unpurified clay therein.

18. An article having a plurality of layers wherein at least one layer is formed from the nanocomposite of claim 1.

19. The article of claim 18, wherein the nanocomposite is disposed between two other layers.

20. A multi-layer article having low haze comprising:

(a) at least two structural polymer layers comprising poly(ethylene terephthalate), or a copolymer thereof; and

(b) a barrier layer disposed between the at least two structural layers comprising a melt-processible matrix polyamide and a layered clay material having less than about 2.0 % by weight of quartz, based on the weight of the clay material, wherein the clay material is incorporated in the matrix polyamide.

21. The article of claim 20, wherein the melt-processible matrix polyamide comprises poly(*m*-xylylene adipamide) or a copolymer thereof, and the clay material comprises sodium montmorillonite or sodium bentonite.

22. A process for preparing a polymer-clay nanocomposite comprising the steps of:

(i) forming a concentrate comprising an oligomeric resin and a layered clay material having less than about 2.0 % by weight of quartz, based on the weight of the clay material, and

(ii) melt mixing the concentrate with a melt-processible matrix polymer to form a polymer-clay nanocomposite.

23. The process of claim 22, wherein steps (i) and (ii) are conducted by a batch mixing or a melt compounding extrusion process.

24. The process of claim 22, wherein the oligomeric resin and the melt-processible matrix polymer have the same monomer unit.

25. A nanocomposite material produced by the process of claim 22.

26. An article prepared from the nanocomposite material of claim 25.

27. The article of claim 26 in the form of film, sheet, fiber, an extruded article, a molded article, or a molded container or bottle.

28. The article of claim 26 having a gas permeability that is at least about 10 percent lower than that of unmodified polymer.

29. The article of claim 26, having a haze which is at least about 4 percent lower than that of an article formed from a nanocomposite having unpurified clay therein.

30. A process for reducing haze in an article having a nanocomposite material comprising:

(i) preparing a polymer-clay nanocomposite material comprising the step of mixing a melt-processible matrix polymer and a layered clay material having less than about 2.0 % by weight of quartz, based on the weight of the clay material, to form a polymer-clay nanocomposite material; and

(ii) molding an article from the nanocomposite material, wherein the article has a haze which is at least about 4 percent lower than that of an article formed from a nanocomposite having unpurified clay therein.

ABSTRACT

The invention is directed to a polymer-clay nanocomposite material comprising a melt-processible matrix polymer and a layered clay material having low quartz content. This invention is also directed to a process for preparing polymer-clay nanocomposites, and articles or products produced from nanocomposite materials.

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